Engage: Name Your Source!

Purpose:

Participants will investigate a variety of data sources. Assess participants' experience and comfort with various avenues and tools for collecting data. Compare and contrast technology-based data sources with technology-free data sources.

Descriptor:

Participants will rotate through four stations to gather data:

- Internet data sources for archival data
- Internet-based tools for collecting data
- Calculator-based data collection tools
- Technology free data collection tools

Upon completion of the activities at each station, participants will compare and contrast their experiences with Internet data sources and printed data sources. They will also compare and contrast their experiences with calculator-based data collection tools and technology-free data collection tools. Introduce participants to the formulation of questions that will spark data collection and investigation.

Duration:

1.5 hours

Mathematics TEKS Objectives:

6.10A	The student uses statistical representations to analyze data. The student is expected to select and use an appropriate representation for presenting and displaying different graphical representations of the same data including line plot, line graph, bar graph, and stem and leaf plot.
6.10B	The student uses statistical representations to analyze data. The student is expected to identify mean (using concrete objects and pictorial models), median, mode, and range of a set of data.
6.10D	The student uses statistical representations to analyze data. The student is expected to solve problems by collecting, organizing, displaying, and interpreting data.
7.11A	The student understands that the way a set of data is displayed influences its interpretation. The student is expected to select and use an appropriate representation for presenting and displaying relationships among collected data, including line plot, line graph, bar graph, stem and leaf plot, circle graph, and Venn diagrams, and justify the selection.
7.11B	The student understands that the way a set of data is displayed influences its interpretation. The student is expected to make inferences and convincing arguments based on analysis of given or collected data.
7.12A	The student uses measures of central tendency and range to describe a set of data. The student is expected to describe a set of data using mean, median, mode, and range.

7.12B The student uses measures of central tendency and range to describe a set of data. The student is expected to choose among mean, median, mode, or range to describe a set of data and justify the choice for a particular situation.

8.12A The student uses statistical procedures to describe data. The student is expected to select the appropriate measure of central tendency or range to describe a set of data and justify the choice for a particular situation.

8.12A The student uses statistical procedures to describe data. The student is expected to draw conclusions and make predictions by analyzing trends in scatterplots.

8.12C The student uses statistical procedures to describe data. The student is expected to select and use an appropriate representation for presenting and displaying relationships among collected data, including line plots, line graphs, stem and leaf plots, circle graphs, bar graphs, box and whisker plots, histograms, and Venn diagrams, with and without the use of technology.

8.13A The student evaluates predictions and conclusions based on statistical data. The student is expected to evaluate methods of sampling to determine validity of an inference made from a set of data.

8.13B The student evaluates predictions and conclusions based on statistical data. The student is expected to recognize misuses of graphical or numerical information and evaluate predictions and conclusions based on data analysis.

6.11A, 7.13A, 8.14A The student applies Grade 6/7/8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. The student is expected to identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.

6.11D, 7.13D, 8.14D The student applies Grade 6/7/8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. The student is expected to select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.

6.12A, 7.14A, 8.15A The student communicates about Grade 6/7/8 mathematics through informal and mathematical language, representations, and models. The student is expected to communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.

6.12B, 7.14B, 8.15B The student communicates about Grade 6/7/8 mathematics through informal and mathematical language, representations, and models. The student is expected to evaluate the effectiveness of different representations to communicate ideas.

6.13A, 7.15A, 8.16A The student uses logical reasoning to make conjectures and verify conclusions. The student is expected to make conjectures from patterns or sets of examples and nonexamples.

6.13B, 7.15B, 8.16B The student uses logical reasoning to make conjectures and verify conclusions. The student is expected to validate his/her conclusions using mathematical properties and relationships.

Technology Applications TEKS Objectives:

(1)(H) Use terminology related to the Internet appropriately, including but not limited to, electronic mail (e-mail), Uniform Resource Locators (URLs), electronic bookmarks, local are networks (LANs), wide area networks (WANs), World Wide Web (WWW) page, and HyperText Markup Language (HTML).

(2)(A) Demonstrate proficiency in the use of a variety of input devices such as mouse/track pad, keyboard, microphone, digital camera, printer, scanner, disk/disc, modem, CD-ROM, or joystick.

(3)(D) Identify the impact of technology applications on society through research, interviews, and personal observation.

(3)(E) Demonstrate knowledge of the relevancy of technology to future careers, life-long learning, and daily living for individuals of all ages.

(4)(A) Use strategies to locate and acquire desired information on LANs and WANs, including the Internet, intranet, and collaborative software.

(6)(C) Demonstrate the ability to identify the source, location, media type, relevancy, and content validity of available information.

(7)(H) Use interactive virtual environments, appropriate to level, such as virtual reality or simulations.

TAKS:

- Objective 5: Probability and Statistics
- Objective 6: Underlying Processes and Mathematical Tools

Technology:

- Internet Websites:
  M&Ms *http://www1.mms.com/us*
  Hit the Dot *http://faculty.washington.edu/chudler/java/dottime.html*
- Calculator-based ranger and graphing calculator

Materials:

Advance Preparation: Create survey statements on chart paper for the recording of individual responses. Print **Data Station Cards** using a color printer. Recreate Venn diagrams from the **Reflections on Data** activity sheet on large chart paper. Create one set of Venn diagrams for every 12 participants. Cut out 36 one-inch squares for each Data Station D that will be made available to participants.

Presenter(s): Internet access and projection device, overhead graphing calculator, PowerPoint slides or transparencies of transparencies and activity sheets

Per group:
Data Station A: Computer with Internet access
Data Station B: Computer with Internet access
Data Station C: CBR and graphing calculator
Data Station D: One-inch color tiles, one-inch cubes, one-inch paper squares, yard sticks

Per Participant:	Sticky dots, **Data Station** recording sheets for **Stations A-D**, **Reflections on Data** activity sheets, **Debriefing the Exploration of Data** activity sheet, **Planning for Intentional Use of Data in the Classroom** activity sheet

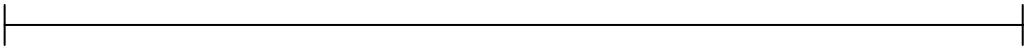
Leader Notes:

The goal of the Engage phase is to begin conversations about data. As teachers see the value of data and the mathematics that can be explored and reinforced through the use of data, they will begin to seek data. Technology offers the tools to make sense of data efficiently. Technology also offers effective means for representing data so that analysis may take place. Encourage participants to interact with each other. The presenter(s) should move around the room to facilitate the activity. Use the ***Facilitation Questions*** *to guide and redirect participants, as needed.*

Engage

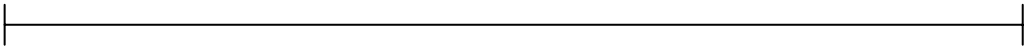
1. *Record the following statements on chart paper. Post these statements around the room.*

Technology offers the opportunity to strengthen mathematical learning in my classroom.



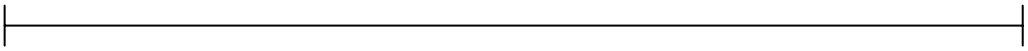
Strongly Disagree — Strongly Agree

Students should learn first with paper-and-pencil methods and then with technology.



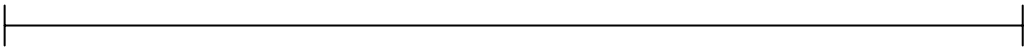
Strongly Disagree — Strongly Agree

My students know how to discern which of these methods best serves the purposes of a given problem: mental strategies, paper-and-pencil techniques, and technology applications.



Strongly Disagree — Strongly Agree

The best technology tool for the mathematics classroom is the graphing calculator.



Strongly Disagree — Strongly Agree

2. *As participants enter the session, direct them to respond to the posted statements by placing a marker, such as a sticky dot, in the location that best corresponds to their response. Use only one color of sticky dot for this activity.*

3. *As you provide a welcome and introduction to this professional development session, direct the participants' attention to the posted statements, noting that they will explore their reflections about these statements in greater detail during the course of this professional development.*

4. *Distribute a **Data Station Card** to each participant. Direct the participants to move to the station described on his or her card.*

> ***Archival data** are data that are not, under normal circumstances, subject to change. Examples of archival data include results from concluded research, medical records, and historical data.*
> ***Dynamic data** are data that are, under normal circumstances, subject to change. The data may be updated routinely or on request. An example of dynamic data is survey results that update based on each new response.*
> ***Categorical data** reflect data organized by category rather than by number. The frequencies of the categorical data are counted. Examples of categorical data include favorite color, voting, males/females, etc.*
> ***Numerical data** are data that reflect measurable, quantifiable attributes. The measures, rather than the attributes, form the data. Examples of numerical data include measures of length, measures of radio frequency, measures of time, etc.*

5. *After participants have moved to the appropriate station, model the activity at Station A for the whole group using a projection system so that participants understand the intent of the activity. Avoid walking the participants through the entire activity sheet so that the groups at Station A still have a meaningful learning experience. Direct participants to the M&Ms® website at http://www1.mms.com/us. Demonstrate linking to the "About M&M's®" webpage by using the pop-down menu located under "About M&M's®" and clicking on Products. Click on one of the products to see data about this product.*

Facilitation Questions

- What data does this webpage provide? How would we record this information on the **Data Station A Recording Sheet**?
  Answers may vary. Color distribution within a product, nutritional data, packaging size.
- Are the data numerical, categorical, or both? How would we record this on the **Data Station A Recording Sheet**?
  The data are numerical and categorical.
- What relationships are present in this data? Why? How would we record this on the **Data Station A Recording Sheet**?
  Answers may vary. The percentages represent the part-to-whole part relationship.

6. *Explain that the time allotted for each data station is 12 minutes. In these 12 minute segments, the participants should explore the given data source while recording observations and notes on the station's recording sheet. A count-down timer is a beneficial tool for keeping participants on task.*

7. *Walk to each data station, clarifying directions as necessary and prompting discussion as necessary.*

Facilitation Questions

Data Station A

- What numerical data have you found?
  Answers may vary. Percentages describing color ratios, nutritional quantities, etc.
- What categorical data have you found?
  Answers may vary. Colors represented in each type of candy, etc.
- What relationships occur within the numerical data? Why?
  Answers may vary.
- What relationships occur within the categorical data? Why?
  Answers may vary.
- How might you describe the nutritional aspects of this product using a circle graph?
  Answers may vary. Represent the portion of the recommended daily allowance of fat contained in one package of candy.
- How might you represent other aspects of this product?
  Answers may vary.
- What question(s) can we pose to students that would require them to gather data on two or more products?
  Answers may vary. If we were to mix one bag of two types of candies together, what would be the color distribution of the mixture?

Data Station B

- What numerical data did you generate?
  Answers may vary. A score, an updated representation of activity results, etc.1
- What categorical data did you generate?
  Answers may vary. Ranges of scores.
- What relationships occur within the numerical data? Why?
  Answers may vary. Percentages falling within certain ranges of scores, etc.
- How might you summarize the data generated by your group?
  Answers may vary. For example, the group might have a second individual counting the number of mouse clicks for the purpose of comparing this data to the score obtained to determine accuracy rates.
- How might you represent the data generated by your group?
  Answers may vary.
- To what real-life experiences might our students relate this data collection activity?
  Answers may vary.

Facilitation Questions

Data Station C

- What numerical data did you generate?
  Answers may vary.
- What categorical data did you generate?
  Answers may vary.
- What relationships occur within the numerical data? Why?
  Answers may vary.
- What relationships occur within the categorical data? Why?
  Answers may vary.
- How might you summarize the data generated by your group?
  Answers may vary.
- To what real-life experiences might our students relate this data collection activity?
  Answers may vary.

Data Station D

- What numerical data did you generate?
  Answers may vary.
- What categorical data did you generate?
  Answers may vary.
- What relationships occur within the numerical data? Why?
  Answers may vary.
- What relationships occur within the categorical data? Why?
  Answers may vary.
- How might you summarize the data generated by your group?
  Answers may vary.
- How might you represent the data generated by your group?
  Answers may vary.
- How might you use these tools to generate two sets of data for comparison purposes?
  Answers may vary.
- To what real-life experiences might our students relate this data collection activity?
  Answers may vary.

8. *After 12 minutes have passed, direct the participants to rotate to the next data station. Data Station D participants should move to Data Station A, Data Station A participants should move to Data Station B, etc. Allow approximately 3 minutes to transition between groups.*

9. *Repeat the rotation until each group has been at each data station. Continue to use the facilitation questions as needed.*

10. *Upon completing rotation through each station, reorganize participants into groups of 4. If using the* ***Data Station Cards,*** *regroup by color. Prompt the participants to complete the*

Reflections on Data *activity sheet individually. They are in groups of 4 to simplify the transition to groups of 12. Allow approximately 5 minutes for each individual's completion of these activity sheets.*

11. *While the participants are completing their individual Reflections on Data activity sheets, post 1 set of Venn Diagrams for every 12 participants.*

12. *Prompt participants to move to the chart paper Venn diagrams in groups of 12 by combining 3 existing groups of 4 participants. Prompt participants tol work silently in these groups of 12 to create summary Venn diagrams of the three groups' discussions.*

13. *Prompt the group to identify the person with the longest hair. This person will be the first recorder. Prompt this person to record one statement on the large chart paper Venn diagrams. The statement may be a personal observation or an observation from the group's Venn diagrams.*

14. *Prompt the participant to pass the marker to a new recorder, preferably a person who was not a member of his or her discussion group. This person will record a new statement on the Venn diagram. Prompt participants to continue this process until each participant has had an opportunity to record a statement. Participants may record new observations or statements that occur as a result of seeing the reflections of others.* ***Note****: Depending on time, you may choose to have multiple participants recording on the Venn diagrams at the same time.*

Facilitation Questions

- Which similarities did each group note?
  Answers may vary.
- Which similarities were new to you?
  Answers may vary.
- Which differences did each group note?
  Answers may vary.
- Which differences were new to you?
  Answers may vary.
- What are the benefits of an archival data source?
  Answers may vary. The teacher is able to prepare models of representations to which students can compare their efforts.
- What are the benefits of a dynamic data source, such as the applet used to generate data at Station B?
  Answers may vary. Dynamic data sources engage students' interest.
- What are the benefits of a CBR data source over a technology-free data source?
  Answers may vary. The CBR provides dynamic data in a graphical representation.
- What are the benefits over a technology-free data source over a CBR data source?
  Answers may vary. Technology-free data allows for timely exploration when technology resources may not be available or accessible.

*15. Distribute the **Debriefing the Exploration of Data** activity sheet. Prompt participants to reflect upon the discussions summarized by the Venn diagrams and record their responses to each of the questions posed on the activity sheet. After a few minutes of recording time, prompt the participants to share their responses with another participant. Debrief the responses in whole-group setting, keeping in mind that the goal of this phase of the professional development is to consider data.*

Facilitation Questions

- When might an archival data source support the learning of the math TEKS?
  Answers may vary.
- When might a dynamic data source support the learning of the math TEKS?
  Answers may vary.
- Are trends more apparent in data resulting from an archival or a dynamic data source? Why?
  Answers may vary.
- What are the limitations of an archival data source?
  Answers may vary.
- What are the limitations of a dynamic data source?
  Answers may vary.
- How might these limitations impact the learning of the math TEKS?
  Answers may vary.
- What topics in middle school mathematics lend themselves to archival data?
  Answers may vary.
- How do internet-based data sources serve to engage students in the learning process?
  Answers may vary.
- How might you use internet-based data sources to assess student learning?
  Answers may vary.
- Looking at the two Venn diagrams, how are the data sources related?
  Answers may vary.
- Looking at the two Venn diagrams, how are the data sources different?
  Answers may vary.

16. *Pose the questions listed below to the whole group. Explain to the participants that these questions serve as "filtering questions" when seeking to incorporate the use of data into classroom instruction.*
    a. *What TEKS in a particular unit of study are enhanced through the use of data?*
    b. *What data are required to enhance the study of these TEKS?*
    c. *What question(s) may be answered using this data?*
    d. *How does using data allow one to increase the rigor of the learning experience? How might using data move the learner from remembering, understanding, and applying to analyzing and evaluating?*
    e. *What type of data would be most useful for the stated TEKS?*
    f. *What setting will be available during instruction related to these mathematical goals?*
    g. *What actual data source(s) may prove helpful in enhancing mathematical learning related to these TEKS?*

17. *Distribute the **Planning for Intentional Use of Data in the Classroom** activity sheet to each participant. Share with the participants that these reflective questions form the basis for the **Planning for Intentional Use of Data in the Classroom** activity. Share with the participants that these filtering questions helped to develop each of the activities contained within this professional development. This template will serve as a reflection tool to summarize each activity that follows in order to identify elements that support the judicious use of technology.*

Data Station Card

**Print in color.

Station A	Station B	Station C	Station D
Station A	Station B	Station C	Station D
Station A	Station B	Station C	Station D
Station A	Station B	Station C	Station D
Station A	Station B	Station C	Station D
Station A	Station B	Station C	Station D
Station A	Station B	Station C	Station D
Station A	Station B	Station C	Station D

Data Station A Recording Sheet

Data Source	http://www1.mms.com/us Link to the "About M&M's®" webpage by using the pop-down menu located under "About M&M's®" and clicking on Products.
How would you describe this set of data? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

Data Station B Recording Sheet

Data Source	http://faculty.washington.edu/chudler/java/dottime.html
How would you describe this set of data? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

You will need to delete the cookie for this website to record data for each participant.

Data Station C Recording Sheet

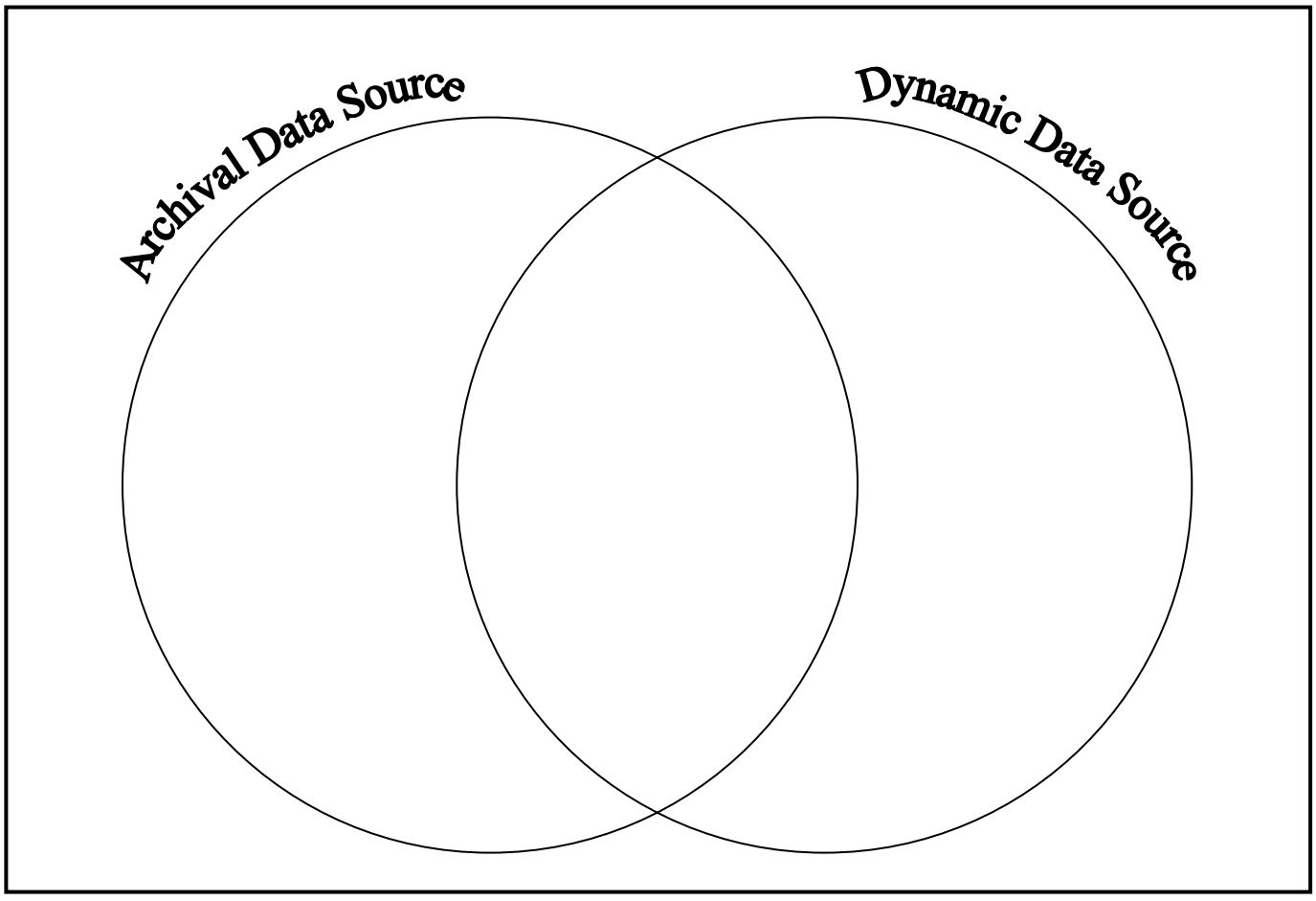
Data Source	CBR and graphing calculator
How would you describe the data generated by these tools? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

Data Station D Recording Sheet

Data Source	Color tiles, one-inch cubes, one-inch paper squares, yard sticks
How would you describe the data generated by these tools? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

Reflections on Data

Complete the following Venn Diagram to compare and contrast the uses of archival and dynamic data found on the Internet.



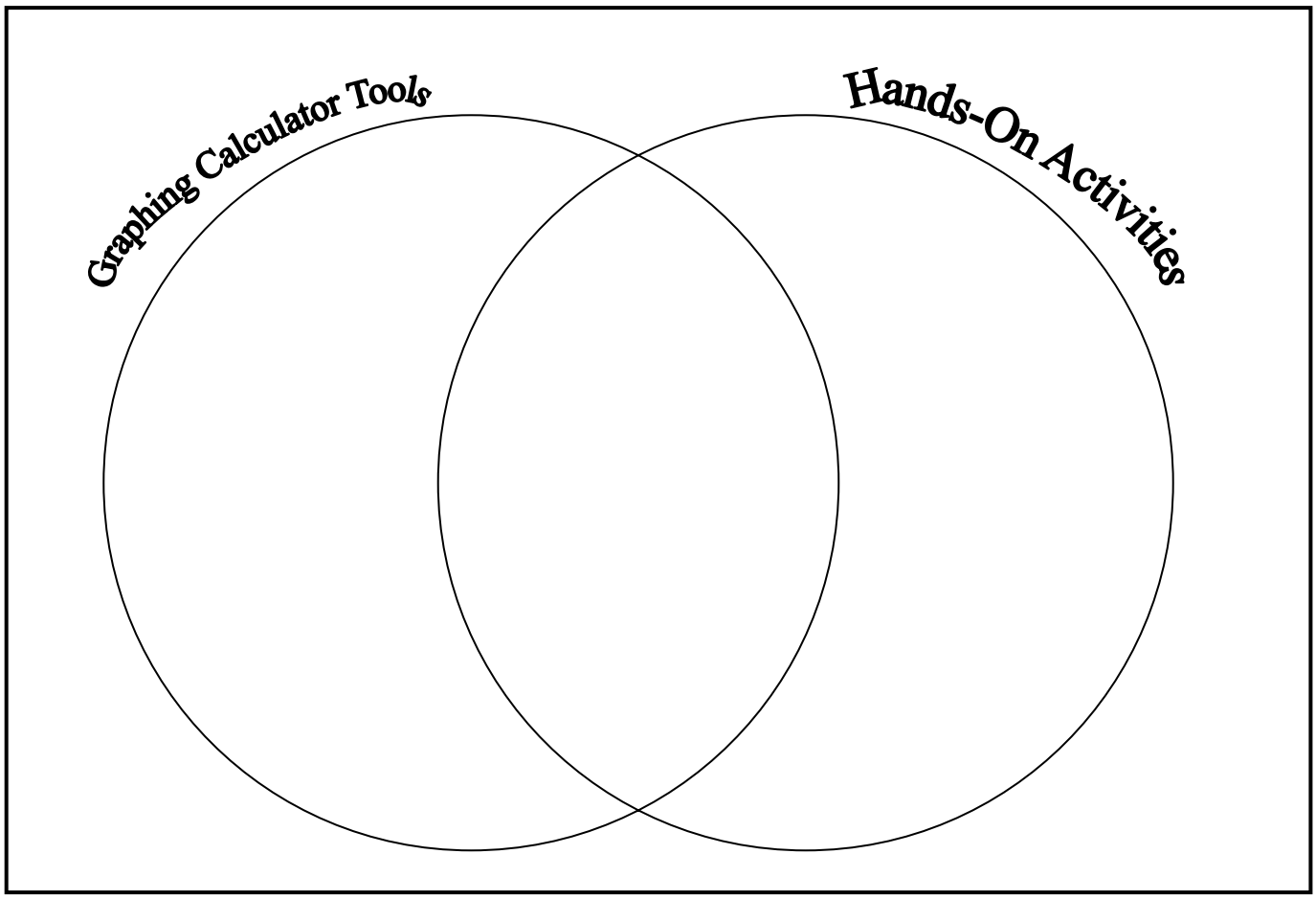
What are the benefits of using archival data found on the Internet?

What are the benefits of using a dynamic data source, such as an applet on the Internet?

How might teachers use these data sources in a middle school mathematics classroom?

Reflections on Data

Complete the following Venn Diagram to compare and contrast the uses of the graphing calculator tools and hands-on activities as data sources.



What are the benefits of using data resulting from graphing calculator tools?

What are the benefits of using data derived from hands-on activities?

How might teachers use these data sources in a middle school mathematics classroom?

Debriefing the Exploration of Data

1. What questions can we ask as reflective practitioners to determine the appropriateness of a data source for promoting mathematical learning?

2. How does the technology-based data offer an opportunity to strengthen mathematical learning?

3. How might hands-on activities complement the judicious use of technology?

4. What paper-and-pencil methods do students need to know to make sense of the data we explored?

Planning for Intentional Use of Data in the Classroom

TEKS	Math		
	Tech Apps		
Question(s) to Pose to Students	Math		
	Tech Apps		
Cognitive Rigor		Knowledge	
		Understanding	
		Application	
		Analysis	
		Evaluation	
		Creation	
Data Source(s)		Real-Time	
		Archival	
		Categorical	
		Numerical	
Setting		Computer Lab	
		Mini-Lab	
		One Computer	
		Graphing Calculator	
		Measurement Based Data	
Bridge to the Classroom			